

WHAT IS CLAIMED IS:

1. An organic EL element comprising, between a positive electrode and a negative electrode, at least a luminescent layer, a hole transport layer adjacent to a positive-electrode side of the luminescent layer, and an electron injection transport layer adjacent to a negative-electrode side of the luminescent layer, wherein

a hole injection layer is provided between the hole transport layer and the positive electrode, and the conductivity of the hole injection layer continuously changes along a thickness direction of the hole injection layer.

2. The organic EL element as described in Claim 1, wherein the hole injection layer includes an acceptor.

3. The organic EL element as described in Claim 2, wherein the concentration of the acceptor in the hole injection layer changes continuously along the thickness direction of the hole injection layer.

4. The organic EL element as described in Claim 2, wherein the hole injection layer has a border region with a reduced acceptor concentration formed in the vicinity of an interface between the hole injection layer and the hole transport layer.

5. The organic EL element as described in Claim 4, wherein the acceptor concentration in the hole injection layer changes by at least 10% in the vicinity of the interface.

6. The organic EL element as described in Claim 2, wherein the hole injection layer has a border region with a reduced acceptor concentration formed in the vicinity of an interface between the hole injection layer and the positive electrode.

7. The organic EL element as described in Claim 6, wherein the acceptor concentration in the hole injection layer changes by at least 10% in the vicinity of the interface.

8. The organic EL element as described in Claim 2, wherein the hole injection layer

has first and second border regions with reduced acceptor concentrations in the vicinity of an interface between the hole injection layer and the hole transport layer and in the vicinity of another interface between the hole injection layer and the positive electrode, respectively.

9. The organic EL element as described in Claim 2, wherein the hole injection layer comprises 4,4',4''-tris(2-naphthylphenylamino)triphenylamine, and the acceptor comprises 2,3,5,6-tetrafluoro-7,7,8,8-tetracyanoquinodimethane.

10. The organic EL element as described in Claim 1, wherein the positive electrode comprises a conductive oxide, and the hole injection layer has a film thickness of 40 to 50 nm.

11. An organic EL display apparatus comprising an organic EL element comprising, between a positive electrode and a negative electrode, at least a luminescent layer, a hole transport layer adjacent to a positive-electrode side of the luminescent layer, and an electron injection transport layer adjacent to a negative-electrode side of the luminescent layer, wherein

a hole injection layer is provided between the hole transport layer and the positive electrode, and the conductivity of the hole injection layer continuously changes along a thickness direction of the hole injection layer.

12. A method of manufacturing an organic EL element comprising:
a step of forming a hole injection layer on a positive electrode provided on a substrate;
a step of forming a hole transport layer on the hole injection layer;
a step of forming a luminescent layer on the hole transport layer;
a step of forming an electron injection transport layer on the luminescent layer; and
a step of forming a negative electrode on the electron injection transport layer,
wherein the step of forming the hole injection layer is conducted by a vacuum deposition method using a deposition source, and the step of forming the hole injection layer includes a step of changing a distance between the deposition source and the substrate to be processed on which the organic EL element is to be provided.

13. The method of manufacturing an organic EL element as described in Claim 12,

wherein an acceptor is introduced into the hole injection layer during the step of forming the hole injection layer, and the concentration of the acceptor in the hole injection layer is changed along a film thickness direction of the hole injection layer during the step of changing the distance from the deposition source.

14. The method of manufacturing an organic EL element as described in Claim 13, wherein the change in the acceptor concentration along the film-thickness direction is an increase in the acceptor concentration.

15. The method of manufacturing an organic EL element as described in Claim 13, wherein the change in the acceptor concentration along the film-thickness direction is a decrease in the acceptor concentration.

16. The method of manufacturing an organic EL element as described in Claim 13, wherein the deposition source is a plurality of deposition sources, and the acceptor is retained in at least one of the plurality of deposition sources.

17. The method of manufacturing an organic EL element as described in Claim 13, wherein a conductivity of the hole injection layer is changed in accordance with the change in the concentration of the acceptor in the hole injection layer.

18. An apparatus for manufacturing an organic EL element comprising:
a processing vessel;
an exhaust unit that exhausts air from the processing vessel;
a retaining table that retains a substrate to be processed and is provided on a first side inside the processing vessel; and
a deposition source that vaporizes a material and is provided on a second side inside the processing vessel facing the first side,

wherein the material vaporized by the deposition source is deposited on the substrate to be processed, and the apparatus further comprises a moving unit that moves the vaporizing unit inside the processing vessel and is configured to move the deposition source at least in a direction from the first side toward the second side or in a direction from the second side toward the first side.

19. The apparatus for manufacturing an organic EL element as described in Claim 18, further comprising a detecting unit that moves with the deposition source and detects an amount of the material vaporized from the deposition source while maintaining a constant distance from the deposition source.

20. The apparatus for manufacturing an organic EL element as described in Claim 18, further comprising a control unit that controls a distance between the substrate to be processed and the deposition source using the moving unit in accordance with the amount of the material vaporized from the deposition source detected by the detecting unit.